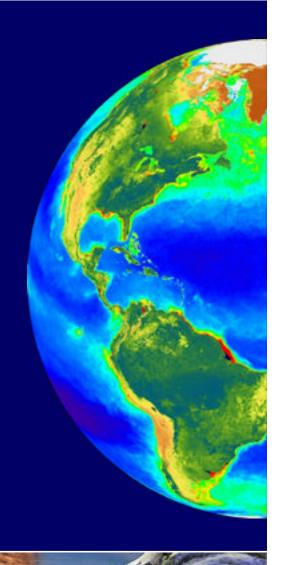


Science: How is the Earth Changing and What Are the Consequences for Life on Earth?

- How is the global Earth system changing?
- What are the primary causes of change in the Earth system?
- How does the Earth system respond to natural and human-induced changes?
- What are the consequences of changes in the Earth system for human civilization?
- How well can we predict future changes to the Earth system?





Establishing Priorities

Science Priority Criteria

Science Return

Benefit to Society

Mandated Program

Appropriate for NASA

Partnership Opportunity*

Technology Readiness

Program Balance

Cost / Budget Context

Implementation Priority Criteria

* Includes potential for handoff to operational systems



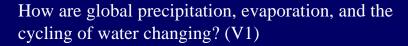


Deriving Measurement Requirements from the Research Strategy

	Variability	Forcing	Response	Consequence	Prediction		
	Precipitation, evaporation & cycling of water changing?	Atmospheric constituents & solar radiation on climate?	Clouds & surface hydrological processes on climate?	Weather variation related to climate variation?	Weather forecasting improvement?		
	Global ocean circulation varying?	Changes in land cover & land use?	Ecosystem responses & affects on global carbon cycle?	Consequences in land cover & land use?	Transient climate variations?		
	Global ecosystems changing?	Surface transformation?	Changes in global ocean circulation?	Coastal region change?	Trends in long-term climate?		
	Stratospheric ozone changing?		Stratospheric trace constituent responses?		Future atmospheric chemical impacts?		
	Ice cover mass changing?		Sea level affected by climate change?		Future concentrations of carbon dioxide and methane?		
	Motions of Earth & interior processes?		Pollution effects?	Requires systema Requires explorate Requires pre-oper	stematic & exploratory satellites atic satellite observations tory satellite observations erational and/or systematic/expl		
00/				Use available/new	observations in better models		



Exploratory Measurement Needs



What are the motions of the Earth and Earth's interior? (V6)

What trends in atmospheric constituents and solar radiation are driving global climate? (F1)

How is the Earth's surface being transformed...? (F2)

What are the effects of clouds and surface hydrological processes on climate change? (R1)

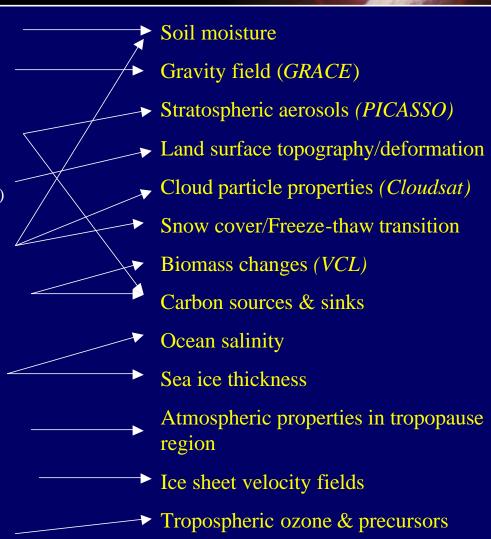
How do ecosystems respond to and affect global environmental change and the global carbon cycle? (R2)

How can climate variations induce changes in global ocean circulation? (R3)

How do stratospheric trace constituents respond to change in climate and chemical composition? (R4)

How is global sea level affected by climate change? (R5)

What are the effects of regional pollution on the global atmosphere...? (R6)





Deriving Measurement Requirements from the Research Strategy

	Variability	Forcing	Response	Consequence		Prediction
	Precipitation, evaporation & cycling of water changing? HYDROS	Atmospheric constituents & solar radiation on climate? OCO	Clouds & surface hydrological processes on climate? HYDROS	Weather variation related to climate variation?		Weather forecasting improvement? ThOR
	Global ocean circulation varying? AQUARIUS	Changes in land cover & land use?	Ecosystem responses: global carbon cycle?	Consequences in land cover & land use?		Transient climate variations? HYDROS
	Global ecosystems changing?	Surface transformation? ECHO, ABYSS	Changes in global ocean circulation? AQUARIUS, ABYSS	Coastal region change?		Trends in long-term climate? AQUARIUS
	Stratospheric ozone changing?		Stratospheric trace constituent responses?			Future atmospheric chemical impacts?
	Ice cover mass changing?		Sea level affected by climate change? ABYSS, ECHO			Future concentrations of carbon dioxide and methane?
	Motions of Earth & interior processes? ECHO		Pollution effects?	Requires system Requires explora Requires pre-ope	ation ator	ematic & exploratory satellites c satellite observations y satellite observations tional and/or systematic/expl
00				Use available/ne	w c	observations in better models



We Will Examine Practically Every Aspect of the Earth System From Space in This Decade

Systematic Missions - Observation of Key Earth System Interactions









Aura

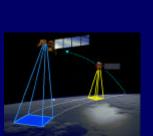
Exploratory - Explore Specific Earth System Processes and Parameters and Demonstrate Technologies







PICASSO





EO-3

EO-1



Science Questions Addressed by EOS Era Missions

Variability

Precipitation, evaporation & cycling of water changing?

Aqua, TRMM

Global ocean circulation varying? **TOPEX, Jason, QuikSCAT**

Global ecosystems changing? **Terra, SeaWiFS**

Stratospheric ozone changing? **QuikTOMS, Aura, SAGE III**

Ice cover mass changing?

ICEsat

Motions of Earth & interior processes?

GRACE

Forcing

Atmospheric constituents & solar radiation on climate? **ACRIM. SORCE**

ACRIM, SORCE QuikTOMS, SAGE

Changes in land cover & land use?

Landsat 7

Surface transformation?

SRTM

Response

Clouds & surface hydrological processes on climate?

Terra, Agua

Ecosystem responses & affects on global carbon cycle?

VCL

Changes in global ocean circulation?

TOPEX, Jason, GRACE

Stratospheric trace constituent responses? **Aura**

Sea level affected by climate change?

Pollution effects?

Consequence

Weather variation related to climate variation?

TRMM, QuikSCAT

Consequences in land cover & land use?

Terra, Landsat 7

Coastal region change?

Trends in

Prediction

Weather forecasting

improvement?

TRMM, QuikSCAT

Transient

climate variations?

TOPEX, Jason

long-term climate?

Future atmospheric chemical impacts?

Future concentrations of carbon dioxide and methane?

Logical Progression of Research Strategy



Systematic Measurement Missions

EOS Era

Terra, Aqua

Landsat 7

TRMM

TOPEX, Jason

QuikSCAT, SeaWinds

TOMS, OMI

ACRIMsat, SORCE

- NPOESS Preparatory Project (2005/06)
- Landsat Data Continuity Mission (2005)
- Global Precipitation Mission (2007)
- Ocean Topography Mission (2006)
- Ocean Surface Winds (2006)
- Total Column Ozone/Aerosols (2008)
- Solar Irradiance (2006)



Science Questions Addressed by EOS Follow-on Missions

Variability Forcing Consequence Response **Prediction** Atmospheric Weather variation Precipitation, Weather forecasting Clouds & surface constituents & solar related to climate evaporation & cycling of improvement? hydrological processes radiation on climate? variation? water changing? GPM, on climate? GPM. Solar Irradiance. NPP NPP, GPM Ocean Winds Ozone/Aerosol Ocean Winds Global ocean **Transient** Consequences Changes in land circulation varying? climate variations? in land cover cover & land use? Ocean & affects on global & land use? Ocean **Topography** carbon cycle? **LCDM** NPP, LDCM **Topography** Ocean Winds Global Changes in global ecosystems changing? Trends in Coastal region change? ocean circulation? long-term climate? **NPP** Stratospheric Stratospheric trace ozone changing? Future atmospheric **Total Column** chemical impacts? Ozone/Aerosol Sea level Future concentrations Ice cover mass affected by climate of carbon dioxide and Logical Progression of Motions of Earth & Research Strategy Pollution effects? interior processes?

(Exploratory Missions TBD)



Step Two Proposal: SCIENCE CONTENT

Science is still the primary filter in the ESSP evaluation process

Respond to issues cited by the Step One evaluation

 Clearly identify changes to the science content from the Step One proposal

